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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/588,008
Filing Date: June 06, 2000
Appellant(s): YANG ET AL.

MAILED

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GROUP 2800

Mr. Thomas D'Amico
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 06/25/2007 appealing from the Office action mailed 09/22/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The following are the related appeals, interferences, and judicial proceedings known to the examiner which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal:

A related appeal in US Patent Application Number 10/281,954, a divisional application of the present application.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,452,178	Emesh et al. (Emesh)	09-1995
6,303,426	Alers	10-2001
6,475,854	Narwankar et al. (Narwankar)	11-2002
6,387,802	Marsh	05-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 7-16, 18-25, 29-31, and 99 are rejected under 35 U.S.C. 102(e) as being anticipated by Iizuka (6,338,996).

With respect to claims 1 and 99, Iizuka discloses a capacitor in a semiconductor device having a bottom conducting layer 28 (fig. 1), wherein the bottom conducting layer 28 forms a bottom electrode (col. 3, lines 35-40); an annealed dielectric layer 30 (fig. 1) over the bottom conducting layer 28, wherein the annealed dielectric layer is annealed with a first annealing process (col. 1, lines 30-35; col. 2, lines 13-15; col. 4, lines 55-60); and a top electrode 32 (fig. 1) that consists of a single top conducting layer (fig. 1) over the dielectric layer 30; wherein the annealed top layer is annealed with a second annealing process (col. 2, line 33; col. 5, lines 20-25) layer. Note that “oxidizing gas anneal” is an anneal performed in a gas mixture with oxygen

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concentration. Note also that the present application invention selects the set of device claims. This means that the patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

As to claim 2, Iizuka discloses that the bottom conducting layer 28 (fig. 1) is formed of a material selected from the noble metal group (col. 3, lines 38-40).

As to claim 3, Iizuka discloses that the bottom conducting layer is formed of a metal (col. 3, lines 38-40).

As to claims 7-8, Iizuka discloses that the bottom conducting layer is formed from material such as platinum (Pt) and Ruthenium (Ru). (col. 3, lines 38-40).

As to claim 9, Iizuka discloses that the capacitor is formed over a conductive plug 18 (fig. 1) or 21 (fig. 2b), and further includes depositing an oxygen barrier 24 or 26 (fig. 1) over the plug 18 or 21 (fig. 1 or fig. 2b) prior to forming the bottom conducting layer 28 (fig. 1).

As to claim 10, Iizuka discloses that the dielectric layer is a dielectric metal oxide layer (col. 3, lines 40-42).

As to claim 11, Iizuka discloses that the dielectric layer has a high dielectric constant that falls within the range as claimed. (e.g. BST, Col. 3, lines 40-42).

As to claims 12-13, Iizuka discloses that the dielectric layer 30 (fig. 1) is formed of a material such as BST. (Col. 3, lines 40-42).

As to claim 14, Iizuka teaches that the dielectric layer 30 (fig. 1) is heated to a temperature above 200 degrees Celsius (col. 4, lines 59-60) to change it to a crystallized

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dielectric layer 30 from an original material that may be an amorphous material (col. 4, lines 55-63, col. 1, lines 30-33).

As to claim 15, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed of a material selected from the noble metal group (col. 3, lines 38-40).

As to claim 16, Iizuka discloses that the top conducting layer 32 is formed of a non-oxidizing metal permeable to oxygen (col. 3, lines 38-40).

As to claims 18-19, 22, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed from material such as platinum (Pt) and Ruthenium (Ru). (col. 3, lines 38-40).

As to claims 20-21, Iizuka discloses that the top and bottom conducting layers 32, 28 (fig. 1) are formed of a material such as platinum (col. 3, lines 38-40) and the dielectric layer 30 (fig. 1) is a BST (col. 3, lines 40-42).

As to claim 23-25, Iizuka discloses that the top conducting layer 32 is annealed with a gas mixture having oxygen compound (col. 5, lines 20-25).

As to claim 29, Iizuka teaches the capacitor is a stacked capacitor (fig. 1).

As to claim 30, the capacitor (fig. 1) further comprises an access transistor (fig. 1) connected to the capacitor (fig. 1).

As to claim 31, the capacitor may be a DRAM (fig. 1).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 4-5 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iizuka, as applied to claim 32, in view of Emesh et al. (5,452,178) (hereinafter Emesh).

Iizuka discloses the invention substantially as claimed. However, Iizuka does not explicitly state that the bottom conducting layer may be formed of a metal alloy or conducting metal oxide, and that the top conducting layer is formed of a conducting metal oxide.

Emesh discloses an analogous method and device having a bottom electrode 54 (fig. 3), a dielectric 60, 64 (fig. 3), and a top electrode 68 (fig. 3), wherein the bottom electrode 54 (fig. 3) may be formed of conductive metal alloy, or conductive metal oxide (col. 7, lines 1-2). The top electrode 68 may be formed of conducting metal oxide (col. 9, lines 40-42).

Therefore, as to claims 4-5, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the bottom electrode of Iizuka with the metal alloy or conductive metal oxide material, as taught by Emesh, so as to provide an alternative material to make the bottom electrode.

As to claim 17, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the top electrode made of

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conductive metal oxide, as taught by Emesh, so as to provide an alternative material to make the top electrode.

6. Claims 6, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iizuka, as applied to claim 32, in view of Alers (6,303,426).

Iizuka discloses the invention substantially as claimed. In particular, Iizuka discloses that the top conducting layer 32 (fig. 1) is formed of platinum (Pt). However, Iizuka does not explicitly state that the bottom conducting layer may be formed of a metal nitride and the dielectric layer may be formed of a Tantalum oxide (TaO) and is crystalline or amorphous material.

Alers discloses an analogous method and device having a bottom electrode 66 (fig. 3), a dielectric layer 70 (fig. 3), and a top electrode 80 (fig. 3), wherein the bottom electrode 66 is made of metal nitride material (col. 3, lines 53-54) and the dielectric layer 70 is formed of Tantalum Oxide (TaO) and is either crystalline or amorphous (col. 3, lines 58-65).

Therefore, as to claim 6, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the bottom electrode made of metal nitride, as taught by Alers, so as to provide an alternative material for the bottom electrode.

As to claim 14, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the dielectric layer made of Tantalum oxide (TaO), as taught by Alers, so as to provide an alternative material for the dielectric layer.

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7. Claims 26-27 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iizuka, as applied to claim 32, in view of Narwankar et al. (6,475,854) (hereinafter Narwankar).

Iizuka discloses the invention substantially as claimed. However, Iizuka does not explicitly disclose that the annealing step is a plasma enhanced annealing, a remote plasma enhanced annealing, or ultraviolet light enhanced annealing.

Narwankar discloses an analogous method and device having a bottom electrode 604 (fig. 6f) , a dielectric layer 606 (fig. 1), and a top electrode 610 (fig. 6f), wherein the top electrode 610 is annealed (col. 11, line 4-5) in an oxygen environment, thereby performing an oxidizing annealing step. The annealing is a plasma enhanced annealing, or remote plasma enhanced annealing (col. 13, lines 14-20) and that the annealing is done at a pressure of 2.5 Torr and performed at 2 minutes (col. 13, lines 10-15).

Therefore, as to claims 26-27, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Iizuka with the annealing such as plasma enhanced annealing, or remote plasma enhanced annealing, as taught by Narwankar, so as to provide an alternative technique to anneal the top electrode.

Alternatively, as to the grounds of rejection under section 103(a), how the top electrode is made, either by plasmas enhanced or ultraviolet light enhanced plasma or by other process, pertaining to other intermediate process step which does not affect the final device. See MPEP § 2113 which discusses the handling of "product by process" claims and recommends the alternative (§ 102 / § 103) grounds of rejection.

Note: The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

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8. Claim 28 is rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Iizuka, as applied to claim 32.

Initially, and with respect to Claim 28, note that a "product by process" claim is directed to the product per se, no matter how actually made. See *In re Thorpe et al.*, 227 USPQ 964 (CAFC, 1985) and the related case law cited therein which make it clear that it is the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe,

even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935).

Note that Applicant has burden of proof in such cases as the above case law makes clear.

Iizuka a top electrode 32 (fig. 1) that consists of a single top conducting layer (fig. 1) over the dielectric layer 30.

As to the grounds of rejection under section 103(a), how the top electrode is made, either by plasmas enhanced or ultraviolet light enhanced plasma or by other process, pertaining to other intermediate process step which does not affect the final device. See MPEP § 2113 which discusses the handling of "product by process" claims and recommends the alternative (§ 102 / § 103) grounds of rejection.

Note: The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

(10) Response to Argument

In the remarks, appellant alleges that Iizuka does not disclose the capacitor having a first annealing process for the dielectric layer and a second annealing process for the top electrode. As stated in the rejection and the response in the previous Office Action, the examiner notes that appellant claims a device (capacitor). The first and second annealing processes pertain to a product-by-process limitation which means under MPEP 2113 the final structure of the device does not depend or affect by the intermediate process steps. Even for arguendo that appellant's limitation of the first and second annealing steps does result in a different structure, Iizuka still meets the limitation because as admitted by appellant also Iizuka teaches the annealing step for the high dielectric layer and another annealing step after the top electrode is formed on the high dielectric layer. Note that in column 1, lines 47-67, Iizuka teaches that it is known in the art that the high dielectric layer (BST) is annealed so as to obtain a sufficient crystallization. However, Iizuka finds that at room temperature the device with the annealed dielectric layer experiences conductivity defect and peeling-off at the contact portion under the lower electrode (column 1, lines 60-65). Thus, Iizuka improves the device by reducing a leak current at room temperature using the annealed dielectric layer (BST) that undergoes the known annealing step and places noble metals for a lower electrode and a top electrode that forms over the annealed dielectric layer. Thereafter, the device undergoes an annealed process using oxygen and nitrogen gas mixture (column 2, lines 40-45). Essentially, the examiner regards the annealed step for the high dielectric layer (BST) as corresponding to appellant's first annealing process and the annealing process of the device after the top electrode is formed on the annealed dielectric layer corresponds to appellant's second annealing process.

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Therefore, the rejection of claims 1-3, 7-16, 18-25, 29-31, and 99 under 35 USC 102 (e) as anticipated by Iizuka is maintained.

Regarding to the rejection of claims 4-5 and 17 under 35 USC 103(a) as being unpatentable over Iizuka in view of Emesh is maintained, Iizuka lacks the teaching of the material for the lower electrode as claimed. Emesh cures the deficiency in Iizuka, because Emesh teaches the metal alloy and the conductive oxide materials are inexpensive materials to use for the bottom electrode. Furthermore, in response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Thus, the rejection of the claims is maintained.

Another, the rejection of claims 6 and 14 under 35 USC 103 (a) as being unpatentable over Iizuka in view of Alers is maintained, because Alers cures the deficiency in Iizuka by teaching that the metal nitride material provides an inexpensive material to make the bottom electrode. In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071,

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5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Thus, the rejection of the claims is maintained.

Another, the rejection of claims 26-27 under 35 USC 102(e)/103 (a) as being unpatentable over Iizuka in view of Narwankar is maintained, because Iizuka in view of Narwankar teaches all of the structural elements of the present invention. In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). As stated in the rejection, how the top electrode is made, either by plasmas enhanced or ultraviolet light enhanced plasma or by other process, pertains to other intermediate process step which does not affect the final device. Thus, the rejection of the claims is maintained.

Lastly, the rejection of claim 28 under 35 USC 102(e)/103 (a) as being unpatentable over Iizuka in view of Marsh is maintained because Iizuka in view of Marsh teaches all of the structural elements as claimed. Regarding to the product-by-process limitation, how the top electrode is made, either by plasmas enhanced or ultraviolet light enhanced plasma or by other process, pertains to other intermediate process step which does not affect the final device. Thus, rejection is maintained.

Regarding to appellant's remarks of the Pre-Appeal Decision sent on 05/24/2007 affirming the rejection of claims 1-31 and 99 in the final Office Action dated 09/22/2006, the

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examiner notes that there was an inadvertent typo in the summary line of the rejected claims which inadvertently left out claims 4-6, 17, 26-28. Nevertheless, since the Pre-Appeal Decision affirmed the final rejection of the present invention's claims 1-31 and 99, the error was simply an inadvertent typo.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/(Vikki) Hoa B Trinh/

Examiner, Art Unit 2814

Conferees:

Mr. Wael Fahmy, Supervisor



Mr. Ricky Mack, Supervisor

